UTAH GEOLOGICAL & MINERALOGICAL SURVEY

QUARTERLY REVIEW

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UGMS Reorganizes Under State Board

Effective July 1, the Utah Geological and Mineralogical Survey and its governing board will be transferred to the Utah Geological and Mineral Survey and a newly created board within the Department of Natural Resources.

The objectives of the reorganized State Survey, although much the same, are more clearly defined and enlarged to include study of geothermal resources, and geologic and topographic hazards that could affect the safety of, or cause economic loss to, the citizens of Utah.

Investigation of various mineral substances contained in State lands will continue, as will collection and distribution of reliable information regarding the mineral industry and mineral resources, topography and geology of the State.

The physical facilities will remain on the University of Utah campus (see *Quarterly Review,* November 1972, p. 3), but the functions, responsibilities and governing board once maintained by the University will be transferred to the Survey and its governing board.

The board shall be comprised of seven members appointed by the governor with the advice and consent of the senate: one knowledgeable in the field of geology as applied to civil engineering, four

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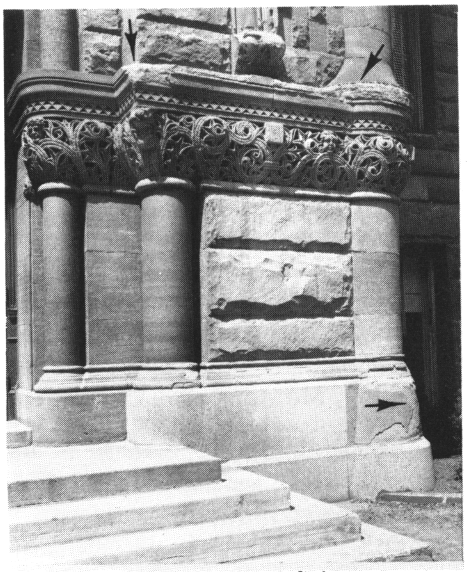
Photomicrograph of exfoliation crack in thin section.



Arrows point to weathered sandstone on cornice and beneath pillar at west entrance of building.

City and County Building

Weather Deteriorates Sandstone Face

As part of decision-making plans preliminary to renovation of the exterior of the City and County Building in Salt Lake City, UGMS engineering geologist, Bruce N. Kaliser, conducted a study to evaluate the effects of weathering on the building's dimension stone.

Thirteen one-inch core samples were taken from the Kyune Sandstone face from the first floor level to the tower and analyzed using petrographic and binocular microscopes for mineralogic alteration, chemical decomposition, exfoliation planes and fractures.

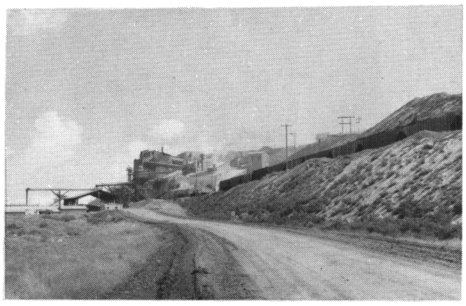
According to Kaliser, all evidence points to the natural creation of exfoliation surfaces as the result of water penetrating and repeatedly freezing and thawing in the spaces between the sand grains. Exfoliation frequently is observed in the natural environment in Utah's deserts.

The greatest penetration, 40 mm or 1.6 inches, was indicated from a core on the west side of the building, probably the result of predominant winds aiding the penetration of the stone.

Construction of the historic building took three years and $900,000 to build in the 1890's.[1] Today, after more than 79 years of use, it would cost $15 million to build or more than $3 million to restore, according to figures provided to the City and County commissions by the consulting architect on the project.

[1] See UGMS' Special Studies 38, "Engineering Geology of the City and County Building, Salt Lake City, Utah," by B. N. Kaliser for more detail.

Phosphate ore from the Rex Peak area, stockpiled in the Brazier Canyon area near the Frank mine, is hauled to the Leefe plant about 12 miles north.



Stauffer Chemical Co.'s phosphate rock beneficiating plant, Leefe, Wyoming. Rail cars transport concentrate to the Garfield plant in Salt Lake County.

Overall Production Up

Phosphate Industry Grows in Utah

Phosphate rock is mined from four general areas in the nation: Florida, North Carolina, Tennessee and the western states of Idaho, Wyoming, Montana and Utah.

According to U. S. Bureau of Mines figures, the U. S. produced about 26 million short tons of phosphate rock in 1965 and approximately 42.4 million short tons, valued at $222.9 million, in 1972.

The increased production is a direct result of a growing demand for phosphate fertilizer; about 90 percent of Utah's phosphate production, which has increased by an average of more than 19 percent per year in recent years, goes to making phosphate fertilizer.

Utah's operations are controlled by Stauffer Chemical Co. with open-pit works in the Rex Peak area in the Crawford Mountains, Rich County, and 12 miles north of Vernal on the south flank of the Uinta Mountains.

Some 30 truckloads carrying approximately 65 tons of ore are hauled daily to a beneficiating plant at Leefe, Wyoming. Washer methods, put into effect last year, have reduced particulate matter and pollution considerably. The concentrate is then shipped by rail to the division plant at Garfield, Utah.

Stauffer recently announced plans to enlarge their phosphate mining and beneficiating operation at Vernal by some 40 percent. Production volume will increase to nearly 400,000 tons.

Survey Releases Latest Studies

Since November of last year, Utah Survey has published the following (available for purchase in person or by mail from Publications Office, 103 Utah Geological Survey Bldg., University of Utah 84112; add 10 percent for handling if ordering by mail):

Special Studies 41, "A Sulfur Isotopic Study of Uinta Basin Hydrocarbons," by R. L. Mauger, R. B. Kayser and J. W. Gwynn ($1.50). Results of sulfur isotope analyses of tar from oil-impregnated sandstones, crude oils and solid hydrocarbons from the Uinta Basin (Tertiary), Utah, are given and the δS^{34} values are related to origin of the tars and the stratigraphy of the area.

Special Studies 42, "Geology and Diatremes of Desert Mountain, Utah," by D. C. Rees, M. P. Erickson and J. A. Whelan ($1.50). The geomorphology, stratigraphy, geologic and regional structure and hydrothermal alteration of the Desert Mountain area in Juab County, Utah, are detailed. A geologic map in a back pocket accompanies the text.

Special Studies 43, "Geochemical Reconnaissance at Mercur, Utah," by G. W. Lenzi ($1.50). Samples mainly from the Mercur, Sunshine and West Mercur areas were assayed for gold and silver and some sample splits not used in the commercial assay were analyzed by atomic-absorption spectrometry for copper and silver. Anomalously high values are located.

Earth Science Series No. 3, "The Earth Below the Hall of Justice, Salt Lake City, Utah," by Richard Van Horn ($.10 postage). Interesting bits of information about Lake Bonneville and the whole Salt Lake City area were revealed in the excavation for the basement of the Hall of Justice. A geologic cross section and airphoto illustrate the explanation of how the underlying structure came to be.

Oil and Gas Field Studies 4 through 12, by P. R. Peterson: No. 4, "Salt Wash Field" ($1.00); No. 5, "Bridger Lake Field" ($1.50); No. 6, "Horseshoe Bend Field" ($1.50); No. 7, "Upper Valley Field" ($1.50); No. 8, "Castle Peak and Monument Butte Fields" ($1.50); No. 9, "Fence Canyon Field" ($1.00); No. 10, "Cedar Rim Area" ($1.50); No. 11, "Flat Rock Area" ($1.00); and No. 12, "Bluebell Field" ($2.00).

A map depicting the structure of the field, stratigraphic data where significant to production, and a type log cover each field. Accompanying text details the field's discovery, development, reservoir data and production statistics, and describes its geology.

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At Home With Geology

Water Drainage Damages Home Sites

by B. N. Kaliser
UGMS Engineering Geologist

The surface water drainage of any prospective subdivision or single home site should be examined critically to evaluate hazardous or potentially damaging situations. A perennial stream on or bordering the site could flood periodically; a dry drainage or swale cutting the site could disgorge floodwaters and debris in the aftermath of a summer cloudburst.

The direction and stability of the drainage channels help define potential hazards as does a uniform or changing slope. The slope determines the velocity of the flow which, in turn, determines whether the sediment load increases or decreases. An increase could denote an erosion condition, a decrease, a sedimentation or clean-up problem. Evidence of relatively recent material deposited on the site could signal possible recurrent sedimentation or clean-up problems in the future. Landscaping could be ruined and swimming pools filled with debris. Evidence of removal of material from the site could portend future erosion which can undermine pavement, landscaping and the house foundation itself. Water seeping out onto the surface or infiltrating into the subsurface also can have deleterious effects.

Sediment deposited over mobile home pad on Bonneville Terrace in Davis County. Note typical fan shape of deposit over break-in-slope.

Using data about the site's drainage basin–its size and runoff characteristics, upstream and downstream–engineers can design storm sewers to accommodate flooding. The creation of impermeable surfaces, as in a new subdivision, however, aggravates the flooding hazard. Sediment and debris is carried farther down the drainage basin before being deposited in what might already be an urbanized area.

Streets become avenues of drainage and should complement the natural drainage system. Adequately designed culverts and bridges must be provided so that flood flows are not impeded. Impounding waters behind such structures can inundate homes and create a general hazard in itself.

Summary Details Oil and Gas Trends

In a unique summary of worldwide onshore and offshore oil and gas and selected mineral resources, John P. Albers, associate chief geologist, USGS, Washington, D. C., analyzes salient data and shows historical trends and possible future directions of new developments.

Available as USGS Professional Paper 817 ($2.10 at the USGS Inquiries Office, 125 S. State, Salt Lake City, Utah), the report highlights the following:

Annual production of oil in the United States rose from about 2,900 million barrels in 1960 to 4,091 million barrels in 1971. During the same period gas production rose from 14,945 billion cubic feet to 23,905 billion cubic feet.

Proved oil reserves for the world total about 634 billion barrels (511 onshore and 101 offshore plus an additional 22 billion for which onshore-offshore distribution data are not available); for the United States, 45.3 billion barrels (39.6 onshore and 5.7 offshore); and for the Soviet Union, about 75 billion barrels (less than 73.6 onshore and greater than 1.4 offshore).

Estimates of total potential oil resources, onshore and offshore, for both the USA and USSR fall within the same broad category: between 100 billion barrels and 1,000 billion barrels.

Asia (including USSR) and North America are the dominant oil producing regions of the world today, and also have the largest reserves for the world of tomorrow. Asia alone, however, contains more than 70 percent of all the reserves of the 120 countries.

The major oil and gas production is shifting from North America to Africa and Asia.

Major gas resources within Asia are located in the USSR. The center of the world supply and production may shift from North America to the area of the USSR east of the Ural Mountains.

The recent trend of increasing production of oil throughout the world is evidenced by the "doubling time" (time required to double production, using 1960 as the base production period). The doubling time is about 2 years for Africa; 7 years for Asia; 2 years for Oceania; and an estimated 20 years for both North and South America. The relatively short doubling period and large production for Africa and Asia explain why the producing center of oil is rapidly shifting to those continents.

Canyon Named To Honor Eardley

The U. S. Board on Geographic Names approved the name Eardley Canyon for a feature in Emery County, Utah.

Howard Ritzma, UGMS petroleum geologist, with the recommendations of several prominent geologists, proposed the name to honor Dr. Armand J. Eardley, a noted Utah geologist who passed away last November. Eardley descended into the canyon in 1930 while a member of a USGS field party and measured and described the older rocks in the deepest parts of the canyon.

Eardley Canyon, 3 miles long along the course of Straight Wash, lies 24 miles southwest of the city of Green River.

Utah Mineral Production–1971

compiled by Carlton H. Stowe
UGMS Minerals Information Specialist

Mineral production and values in Utah for 1971, compiled by the U. S. Bureau of Mines, are given below. For a comparison with 1970 figures, see February 1972 *Quarterly Review*, p. 5.

Commodity	Value	Quantity	
BEAVER COUNTY			
Copper	[6]	[6]	
Pumice	W[1]	W	
Sand and gravel	[6]	[6]	
TOTAL	$ 1,946,000		
BOX ELDER COUNTY			
Lime	W	W	
Salt	W	W	
Sand and gravel	$ 445,000	635,000	s. t.[2]
Stone	W	W	
TOTAL	W		
CACHE COUNTY			
Lime	W	W	
Sand and gravel	$ 620,000	647,000	s. t.
Stone (limestone, quartzite)	417,000	289,000	s. t.
TOTAL	W		
CARBON COUNTY			
Carbon dioxide	W	W	
Coal	W	3,608,000	s. t.
Natural gas	W	W	
Sand and gravel	W	W	
TOTAL	W		
DAGGETT COUNTY			
Natural gas	W	W	
Petroleum	W	6,000	
Sand and gravel	W	W	
Stone	W	W	
TOTAL	W		
DAVIS COUNTY			
Sand and gravel	$ 875,000	1,193,000	s. t.
TOTAL	$ 875,000		
DUCHESNE COUNTY			
Natural gas	W	W	
Petroleum	W	2,984,000	
Sand and gravel	W	W	
Stone	W	W	
TOTAL	W		
EMERY COUNTY			
Coal	W	836,000	s. t.
Natural gas	W	W	
Petroleum	W	5,000	
Sand and gravel	W	W	
Uranium	W	W	
Vanadium	W	W	
TOTAL	$ 6,150,000		
GARFIELD COUNTY			
Petroleum	W	1,948,000	
Sand and gravel	W	W	
Uranium	W	W	
Vanadium	W	W	
TOTAL	$ 6,045,000		
GRAND COUNTY			
Copper	[6]	[6]	
Natural gas	W	9.8 BCF[3]	
Petroleum	W	116,000	
Potassium salts	W		
Sand and gravel	W	W	
Silver	[6]	[6]	
Uranium	W	W	
Vanadium	W	W	
TOTAL	$ 2,710,000		
IRON COUNTY			
Iron ore	W	W	
Pumice	W	W	
Sand and gravel	W	W	
Stone	W	W	
TOTAL	$ 12,049,000		
JUAB COUNTY			
Clays	W	W	
Copper	[6]	[6]	
Fluorspar	W	W	
Lead	[6]	[6]	
Sand and gravel	$ 31,000	47,000	s. t.
Silver	[6]	[6]	
Stone	W	W	
Zinc	[6]	[6]	
TOTAL	$ 884,000		
KANE COUNTY			
Coal	W	12,000	s. t.
Pumice	W	W	
Sand and gravel	W	31,000	s. t.
TOTAL	$ 140,000		
MILLARD COUNTY			
Beryllium concentrates	W	W	
Pumice	W	W	
Sand and gravel	W	W	
TOTAL	W		
MORGAN COUNTY			
Cement, masonry and portland	W	W	
Sand and gravel	$ 36,000	21,000	s. t.
Stone	W	W	
TOTAL	W		
PIUTE COUNTY			
Clays	W	W	
Copper	W	W	
Gold	$ 13,778	334	t. o.[4]
Lead	208,739	756	s. t.
Sand and gravel	29,000	51,000	s. t.
Silver	151,234	97,823	t. o.
Zinc	313,371	973	s. t.
TOTAL	$ 715,000		
RICH COUNTY			
Phosphate rock	W	W	
Sand and gravel	W	W	
TOTAL			

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SALT LAKE COUNTY

Cement, portland	W	W	
Copper	$266,399,068	256,153	s. t.
Gold	12,757,141	309,264	t. o.
Lead	4,788,489	17,350	s. t.
Lime	W	W	
Molybdenum	W	W	
Salt	W	W	
Sand and gravel	3,286,000	3,014,000	s. t.
Silver	5,181,613	3,351,625	t. o.
Stone	W	W	
Zinc	9,737	3,135,283	s. t.
TOTAL	$318,919,000		

SAN JUAN COUNTY

Copper	[6]	[6]	
Natural gas	W	7.6 BCF	
Natural gas liquids	W	W	
Petroleum	W	11,485,000	
Sand and gravel	W	W	
Silver	[6]	[6]	
Uranium	W	W	
Vanadium	W	W	
TOTAL	$ 54,562,000		

SANPETE COUNTY

Clays	W	W	
Salt	W	W	
Sand and gravel	W	W	
TOTAL	W		

SEVIER COUNTY

Clays	W	W	
Coal	W	158,000	s. t.
Gypsum	W	W	
Salt	W	W	
Sand and gravel	W	W	
TOTAL	$ 2,324,000		

SUMMIT COUNTY

Clays	W	W	
Coal	W	12,000	s. t.
Copper	$ 12,948	12	s. t.
Gold	6,146	149	t. o.
Lead	247,848	898	s. t.
Natural gas	W	W	
Petroleum	W	841,000	
Sand and gravel	W	W	
Silver	110,357	71,382	t. o.
Stone	W	W	
Zinc	282,877	879	s. t.
TOTAL	$ 5,747,000		

TOOELE COUNTY

Copper	[6]	[6]	
Gold	[6]	[6]	
Lead	[6]	[6]	
Lime	W	W	
Potassium salts	W	W	
Salt	W	W	
Sand and gravel	W	W	
Silver	[6]	[6]	
Stone (limestone, dolomite, marble)	$ 970,000	W	
Tungsten	W	W	
Zinc	[6]	[6]	
TOTAL	$ 8,911,000		

UINTAH COUNTY

Asphalt and related bitumens	W	W	
Gilsonite	W	W	
Natural gas	W	17.6 BCF	
Natural gas liquids	W	W	
Petroleum	W	6,244,000	
Phosphate rock	W	W	
Sand and gravel	W	W	
Silver	W	W	
TOTAL	$ 30,790,000		

UTAH COUNTY

Clay	W	W	
Gold	W	W	
Lead	W	W	
Lime	W	W	
Manganiferous ore	W	112	l. t.[5]
Sand and gravel	$ 644,000	813,000	s. t.
Stone	W	W	
Zinc	W	W	
TOTAL	$ 9,099,000		

WASATCH COUNTY

Copper	$ 1,445,600	1,390	s. t.
Gold	2,411,352	58,457	t. o.
Lead	1,321,998	4,790	s. t.
Sand and gravel	W	W	
Silver	891,521	576,663	t. o.
Stone	W	W	
Zinc	878,094	2,727	s. t.
TOTAL	–		

WASHINGTON COUNTY

Petroleum	W	W	
Pumice	W	W	
Sand and gravel	$ 72,000	36,000	s. t.
Stone	W	W	
TOTAL	–		

WAYNE COUNTY

Sand and gravel	$ 28,000	103,000	s. t.
Uranium	W	W	
TOTAL	$ 28,000		

WEBER COUNTY

Clays	W	W	
Magnesium compounds	W	W	
Potassium salts	W	W	
Salt	W	W	
Sand and gravel	$ 657,000	611,000	s. t.
Sodium sulfate	W	W	
TOTAL	$ 5,286,000		

Undistributed[1+6]			
Copper	$ 6,131,216	5,896	s. t.
Gemstones	90,000		
Gold	32,671	792	t. o.
Lead	3,995,348	14,475	s. t.
Sand and gravel	3,707,000	3,063,000	s. t.
Silver	1,850,535	1,196,984	t. o.
Stone	3,947,000	2,266,000	s. t.
Zinc	3,666,179	11,385	s. t.
Undisclosed values	35,094,051		
TOTAL	$ 58,514,000		
GRAND TOTAL	$525,694,000		

[1] W = Withheld to avoid disclosing individual company confidential data (by USBM); values are included in county totals. County totals that have been withheld to avoid disclosing individual company confidential data are included with "undistributed."

[2] s .t = short tons

[3] MCF = million cubic feet; BCF = billion cubic feet

[4] t. o. = troy ounces

[5] l. t. = long tons

[6] Production of Beaver, Grand, Juab, San Juan and Tooele counties combined to avoid disclosing individual company confidential data.

Utah Geology In Print 1972

A list of papers appearing in 1972 which pertain to the geology and mineral industry in Utah has been prepared and printed below.

The staff of the University of Utah Engineering and Physical Sciences Library, under the direction of Edith Rich, generously provided the *Quarterly Review* staff with the list of papers. Sylvia Goeltz, UGMS, compiled the subject index.

The papers are listed alphabetically by author and by subject.

The following sources were used to provide information:

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BLAKEY, R. C., 1972, Stratigraphy and depositional environments of Moenkopi Formation in southeastern Utah (abs.): Am. Assoc. Petrol. Geol. Bull., v. 56, no. 3, p. 604.

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COVINGTON, H. R., 1972a, Map showing length of freeze-free season in the Salina

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quadrangle, Utah: U. S. Geol. Survey Misc. Geol. Inv. Map I-591-E.

_____ 1972b, Map showing springs in the Salina quadrangle, Utah: U. S. Geol. Survey Misc. Geol. Inv. Map I-591-G.

_____ 1972c, Topographic relief map of the Salina quadrangle, Utah: U. S. Geol. Survey Misc. Geol. Inv. Map I-591-C.

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SUBJECT INDEX

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SEDIMENTARY PETROLOGY

SEDIMENTATION

STRATIGRAPHY

STRUCTURAL GEOLOGY

SURVEY RELEASES

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Map 31, "Geology of the Escalante-Boulder Area," by C. Carew McFall ($2.00). Single multicolored sheet showing the geology of the Escalante-Boulder area.

Map 33, "Oil-Impregnated Rock Deposits of Utah," compiled by Howard R. Ritzma ($1.50, two sheets). Oil-impregnated rock deposits are located and accompanying text and tables summarize the geology, economic significance and sulfur content of oils extracted from the deposits; updates preliminary Map 25 published in 1968.

Monograph Series No. 2, "Eastern and Northern Utah Coal Fields: Vernal, Henry Mountains, La Sal-San Juan, Sego, Tabby Mountain, Goose Creek, Lost Creek, Coalville and Henrys Fork," by H. H. Doelling and R. L. Graham ($20.00). The second of three in a series to research records, compile data and complete mapping of Utah coal.

The volume is divided into coal fields, areas and quadrangles. Geographic data, geology, mines and development, land ownership and control, coal quality and reserves are treated.

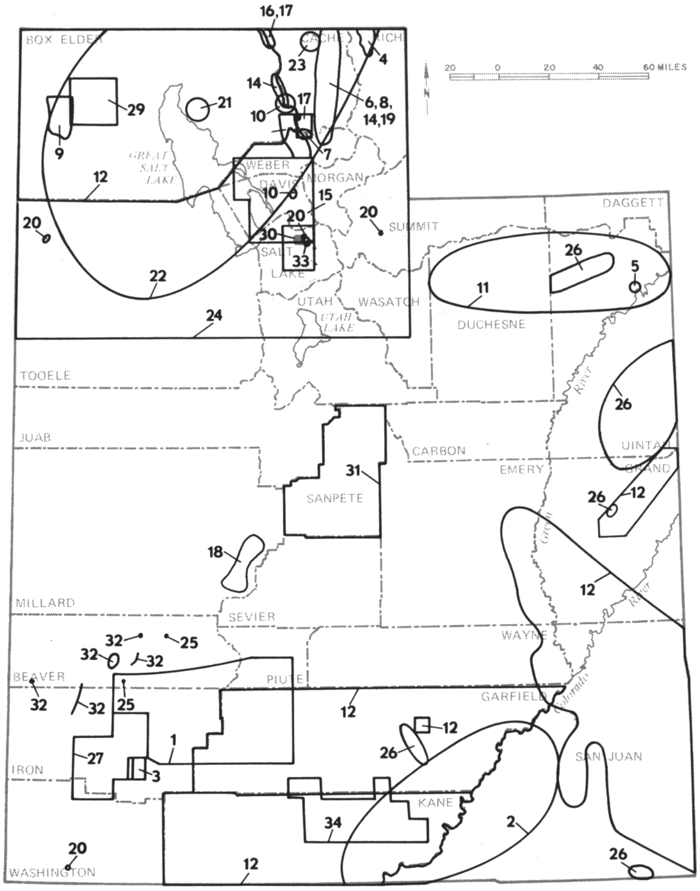
Multicolored maps, and numerous other figures and tables illustrate the 411-page edition.

Monograph Series No. 1, "Southwestern Utah Coal Fields: Alton, Kaiparowits Plateau and Kolob-Harmony," is also available and sells for $17.00; No. 3, "Central Utah Coal Fields: Wasatch Plateau, Book Cliffs, Sevier-Sanpete and Emery" plus a summary of Utah's total coal picture will be released in the near future and will sell for $20.00. The set can be purchased for $50.00.

> *"Civilization exists by geological consent– subject to change without notice."*
> Will Durant

SUMMER FIELD WORK IN UTAH

The geologists who plan to work in Utah during the 1973 field season are listed below. The reference numbers in the left column correspond as far as possible with the location numbers on the accompanying map.



1 Anderson, J. J. Kent State Univ.	Geology of southwest High Plateaus and Black Mountains, Piute, Garfield, Iron and Beaver Counties.
2 Anderson, O. L. and Gordon Jacoby Lake Powell Research	Geohydrology of Kane, Garfield and San Juan Counties.
3 Averitt, Paul and R. L. Threet USGS	Geologic mapping of the Cedar City quadrangle, Iron County.
4 Biesinger, J. C. Utah State Univ.	Mineral assemblages in core samples and their geochemical significance, Bear Lake, Utah-Idaho.
5 Bilbey, Sue Ann Utah State Univ.	Geochemistry and petrography of the Morrison Formation, Dinosaur Quarry quadrangle, Uintah County.
6 Bircher, J. E. Utah State Univ.	Stratigraphy and environmental analysis of the Worm Creek Member of the St. Charles Formation, north central Utah.
7 Blau, J. G. Utah State Univ.	Geology of southern part of James Peak quadrangle, Cache County.
8 Chappell, J. C. Utah State Univ.	Mineralization in the Bear River Range, Utah-Idaho.
9 Compton, Robert Stanford Univ.	General geologic mapping, south Grouse Creek Mountains, Box Elder County.
10 Crittenden, M. D., Jr. USGS	Detailed mapping of Willard Peak area, Ogden Canyon to Brigham City.
11 Dawson, M. R. Carnegie Museum	Upper Eocene mammals, Uinta Basin.
12 Doelling, H. H. UGMS	(a) Box Elder County minerals inventory; (b) Garfield County minerals inventory; (c) Kane County minerals inventory; (d) East Sego coal field mapping; (e) Paradox Basin potash evaluation study.
13 Fuller, R. H. Utah State Univ.	Chemical exchange at the sediment-water interface, Bear Lake, Utah-Idaho.
14 Gardiner, L. L. Utah State Univ.	Environmental analysis of the Upper Cambrian Nounan Formation, Bear River Range, and Wellsville Mountains, north central Utah.
15 Goeltz, N. Sylvia UGMS	Environmental geological atlas, portion of the Wasatch Front area.
16 Gray, W. E. Utah State Univ.	Structural geology of the south part of Clarkston Mountain, Malad Range, Utah-Idaho.
17 Hardy, C. T. Utah State Univ.	(a) Structural geology of James Peak quadrangle, Cache County; (b) Structural geology of Malad and Bannock Ranges, Utah-Idaho.
18 Hickcox, C. W. Univ. of Florida	Pavant Range allochthon, central Utah.
19 Jones, R. L. Utah State Univ.	Clay-water systems and cation-exchange equilibria in three forest soils, Bear River Range, Cache County.
20 Kaliser, B. N. UGMS	(a) Hydrogeologic study, Salt Lake City; (b) Slope stability and geology, Davis County, and Crandall Canyon, Summit County; (c) Gypsiferous residual soils, St. George area; (e) Hydrogeologic evaluation, Bonneville Salt Flats.
21 Kohler, J. F. Utah State Univ.	Morphology, sediment distribution and geochemistry of relict lake-margin deposits in the Rozel Flats area, north Utah.
22 Mecham, Brent Utah State Univ.	Petrography and geochemistry of the Fish Haven and Laketown Dolomites, north central Utah and southeast Idaho.
23 Mendenhall, A. J. Utah State Univ.	Structural geology of east part of Richmond and west part of Naomi Peak quadrangles, Utah-Idaho.
24 Oaks, R. Q., Jr., and R. R. Alexander Utah State Univ.	Depositional environments and stratigraphy of Middle and Upper Cambrian units of north Utah and south Idaho.
25 Peterson, Carol UGMS	Geothermal investigation of Thermal and Roosevelt Hot Springs.
26 Ritzma, H. R. UGMS	(a) Fracture and lineament studies, NE Uinta Basin; (b) Informational core drilling in tar sands; (c) Structure mapping project; (d) Stratigraphic study in Circle Cliffs area; (e) Oil and gas field study, Boundary Butte area.
27 Rowley, P. D. USGS	Geology of the Iron Springs Mining District, Iron County.
28 Summers, P. L. Utah State Univ.	Surficial geology of intermontane valleys, Mount Pisgah quadrangle, Cache County.
29 Todd, V. R. USGS	Stratigraphy and structure of Upper Paleozoic, Mesozoic and Tertiary rocks, Matlin Mountains, Box Elder County.
30 Van Horn, Richard USGS	Detailed geologic ground mapping, Salt Lake City.
31 Weiss, M. P. Northern Ill. Univ.	Geology of Flagstaff Formation, Sanpete County and vicinity.
32 Whelan, J. A. and Lee Perry UGMS	(a) Alteration studies of the Rocky, Star and Indian Peak Ranges; (b) Fluorite studies of Wah Wah and Shauntie Hills.
33 Yeates, E. A. Univ. of Utah	The Intermountain seismic belt and quake hazards along the Wasatch Fault, east of Salt Lake City.
34 Zeller, H. D., Fred Peterson and W. E. Bowers USGS	Coal, geology and stratigraphic studies, Kaiparowits Plateau, Kane and Garfield Counties.

Readiness Reduces Disaster Loss

Although earthquake losses can be reduced substantially only by adequate and enforced building codes, zoning provisions and vigorous community programs designed to strengthen disaster preparedness, an individual can lessen the dangers to himself and his family by learning what to do in the event of an earthquake.

Actual movement of the ground in an earthquake is seldom the direct cause of death or injury; most casualties result from falling objects and debris. Landslides and huge seismic sea waves generated by earthquakes also can cause great damage.

Precautionary actions *before* an earthquake can reduce the dangers:

Citizens should support local safe building codes with efficient inspection and firm enforcement;

School building programs should be supported which provide for the strengthening of old, weak buildings or their replacement with earthquake-resistant structures;

Homeowners or tenants should bolt down or provide other strong support for water heaters and other gas appliances since fire damage can result from broken gas lines and appliance connections;

Sites for construction should be selected and engineered to reduce the hazard of damage from an earthquake;

Occasional home earthquake drills can provide knowledge to avoid injury and panic during an earthquake;

A flashlight and a battery powered transistor radio should be ready for use at all times, and

Immunizations should be kept up to date for all family members.

During an earthquake:

If indoors, watch for falling objects. Stay away from windows, mirrors and chimneys. If shaking is severe, get under a table, desk or bed. Usually, it is best not to run outside;

If in a high-rise office building, get under a desk. Do not dash for exits, since stairways may be broken and jammed with people;

If in a crowded store, do not rush for a doorway. Others may have the same idea, and

If outside, avoid high buildings, walls, power poles and other objects which could fall. Do not run through the streets.

After an earthquake:

Do not attempt to move seriously injured persons unless they are in immediate danger of further injury;

Do not touch downed power lines or objects touched by downed wires. Immediately clean up spilled medicines, drugs and other potentially harmful materials. Emergency water may be obtained from water heaters, toilet tanks, melted ice cubes and canned vegetables or fruits;

Telephones should not be used except for emergencies;

Do not go sightseeing, particularly in beach and waterfront areas where seismic waves could strike, and

Be prepared to respond to requests for help from police, fire-fighting, civil defense and relief organizations.

Accurate prediction of the time and place of earthquakes cannot be made yet. They will continue to harass mankind, occurring most frequently in areas where they have been relatively common in the past.

Above: Dissolution of gypsum salts and resultant collapse of ground surface, St. George area. *Right*: Close-up of "miniature karsts."

HOLE-IN-ONE

Gypsum Dissolves Out, Surface Sinks In

Gypsum, a salt occurring naturally in the substrata, dissolves readily and can cause the ground surface to subside.

The resulting problems are extensive in the St. George area, southeast Utah, because precipitation and runoff waters introduced into the substrata are absorbed easily into the mainly silty and sandy residual soils, playing havoc with the included gypsum cement.

According to Bruce N. Kaliser, Utah Survey engineering geologist, this has been one of the wettest water years of record—more than 4.61 inches of precipitation in the first six months (October through March), or 188 percent of the normal for that period—which has aggravated the situation.

He describes the surface manifestation of the subsidence as a "miniature karst," and is studying its relevance to homeowners.

The Utah Highway Department will use 7 million tons of tailings from Kennecott Copper Corp. flotation concentrators at Magna and Arthur to construct a 5-mile interstate section west of Salt Lake Valley; total project cost is $13.5 million. The tailings will be transported moist to reduce dust.

UGMS REORGANIZES

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representatives of various segments of the mineral industry throughout the State (such as solid fuels, metals and hydrocarbons), one reflecting the economic or scientific interests of the mineral industry in the State and one interested in the goals of the Survey from the public at large. The director of the Division of State Lands will be an *ex officio* member without voting privileges.

Future directors of the Survey will be appointed by the board with the concurrence of the executive director of the Department of Natural Resources. He will be the executive and administrative head of the Survey and will be officially designated as the State geologist.

The move was made to consolidate administrative offices of the Survey and to provide more effective representation before the State legislature.

Earthquake Epicenters

General earthquake epicenters in or near Utah for November and December 1972, with dates of occurrence and approximate magnitudes, are listed below. Unless otherwise indicated, localities are in Utah.

	Magnitude
November	
2 Near Pineview	1.8
3 Near Cedar City	<2.0
7 Heber Valley	2.5
8 Heber Valley	2.8
8 South end of Utah Lake	1.8
9 Near Logan	2.0
9 South Utah-Nevada border	<2.0
12 Heber Valley	1.7
13 Near Mount Pleasant	2.0
13 Near Mount Pleasant	2.0
14 Near Kimball Junction	2.1
15 Near Woodruff	3.0
15 Near Emery	3.1
16 Cedar City (felt)	3.3
17 South Utah-Nevada border	2.3
17 South Utah-Nevada border	2.2
17 South Utah-Nevada border	3.2
22 Near Ephraim	2.2
22 Near Kimball Junction	1.7
23 South Utah-Nevada border	3.3
24 North of Montpelier, Idaho	3.7
25 Near Price	<2.0
29 Near Hamlin Valley, south Utah-Nevada border	3.5
29 Near Hamlin Valley, south Utah-Nevada border	4.0
30 North of Vernal	2.5
30 Heber Valley	<2.0
December	
1 Near Richmond	2.1
1 Near Waterpocket Fold	2.0
5 Near Rangley, Colorado	2.3
6 Southeast of Logan	2.6
6 Southeast of Logan	2.2
6 Southeast of Logan	2.0
8 Near Cedar City	2.0
8 Southeast of Thermopolis, Wyoming (felt)	4.2
9 South of Castle Dale	2.8
9 Near Bear Lake	3.4
9 South of Nephi	2.5
10 North of LaSal	2.0
11 North of Bear Lake in Idaho	3.7
11 North of Bear Lake in Idaho	2.5
15 Near Bear Lake	2.0
17 Near Cedar City	2.0
19 Near Heber City	1.6
19 Near Heber City	1.1
23 South of Sunnyside	2.1
24 Near Heber City	3.0
29 Near south end of Great Salt Lake	2.5
29 Near south end of Great Salt Lake	2.2
29 Near south end of Great Salt Lake	2.2
30 Near south end of Great Salt Lake	2.4
31 Near Cedar City	2.0
31 Near Levan	2.0

These earthquakes were recorded by the University of Utah seismograph stations under the direction of Kenneth L. Cook. All locations and magnitudes are preliminary determinations; the final determinations will be printed in the University of Utah Seismological Bulletin, issued quarterly

QUARTERLY REVIEW

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